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NEW SPECIES OF FLATWORMS FROM NORTH, CENTRAL, AND SOUTH AMERICA

By Libbie H. Hyman

A number of preserved specimens of Turbellaria collected in various parts of North, Central, and South America sent to me for identification by the United States National Museum have all been found to be new species except one. Most of these were fortunately in full sexual maturity, so that it is possible to furnish a complete diagnosis. Those not in the sexual state are also undoubtedly new forms, but a complete description of them must await the fortunate finding of sexually mature material.

Order TRICLADIDA

Suborder Paludicola, or Probursalia

Family PLANARIIDAE

Genus DUGESIA Girard, 1850

In the author's opinion, *Dugesia* Girard is a valid genus, of which *Euplanaria* Hesse, 1897, is a synonym.

DUGESIA TITICACANA, new species

Figure 47, *a–c*

Material examined.—Three specimens, two sexually mature, third young. Both sexual specimens cut into sagittal serial sections, but in one the posterior end with the copulatory apparatus was missing. The other one has hence been made the type.

Description.—External appearance typical of the genus; type specimen (fig. 47, *a*) 5 mm long, 1.8 mm wide, contracted, hence longer and slenderer in life. Head bluntly triangular with blunt auricles and usual two eyes. Pharynx behind the middle.

Color.—Black above, evenly granular, auricles lighter, dark brown below.

Histology.—Dorsal epithelium very thickly beset with rhabdites (fig. 47, *b*); beneath the dorsal epithelium a very wide pigmented region in the parenchyma; just inside this pigmented zone occur the numerous rhabdite-forming gland cells (fig. 47, *b*). Rhabdites, pigment, and rhabdite-forming cells much fewer ventrally than dorsally. Adhesive zone (fig. 47, *b*) very conspicuous at the posterior end, less so at the anterior end; otherwise this species is rather devoid of gland cells. Longitudinal fibers of the subepithelial muscle layer well developed.

Reproductive system.—Typical of the genus. Testes numerous, ventral, of moderate size, extending from just behind the ovaries to the posterior end. Vasa deferentia forming the usual expanded "false" seminal vesicles packed with sperm alongside the pharynx to near their entrance into the penis bulb. Penis typical of the genus, with evident bulb and papilla (fig. 47, *c*). Penis bulb of rounded form containing many muscle fibers coursing parallel to its external contour. The slender terminations of the two vasa deferentia pass separately and without enlargement through the penis bulb and open into the sides of a rounded cavity, the true seminal vesicle, in the penis bulb. This cavity is lined by a tall glandular epithelium, which receives the granular outlets of gland cells situated in the parenchyma of the penis bulb. Penis papilla short, truncate, with a central depression containing a papilla on which the ejaculatory duct opens. The ejaculatory duct is directly continuous with the seminal vesicle in the penis bulb and is lined by a cuboidal epithelium. Penis papilla clothed with a thin epithelium beneath which is a thick layer of circular muscles. Its interior consists of parenchyma with loose longitudinal muscle fibers continuous with those encircling the penis bulb. Ovaries typical, somewhat more posterior to the eyes than the latter are to the anterior tip. The oviducts proceed posteriorly and enter separately the bursa stalk some distance above the entrance of the latter into the genital atrium. Copulatory bursa of moderate size in usual position between the penis bulb and the end of the pharyngeal chamber, saclike, lined by a tall epithelium, and with a thin layer of muscle fibers on its external surface. Bursa stalk fairly large, lined by a tall ciliated epithelium, clothed externally with a well-developed muscle layer of intermingled circular and longitudinal fibers. Genital atrium divided by a descend-

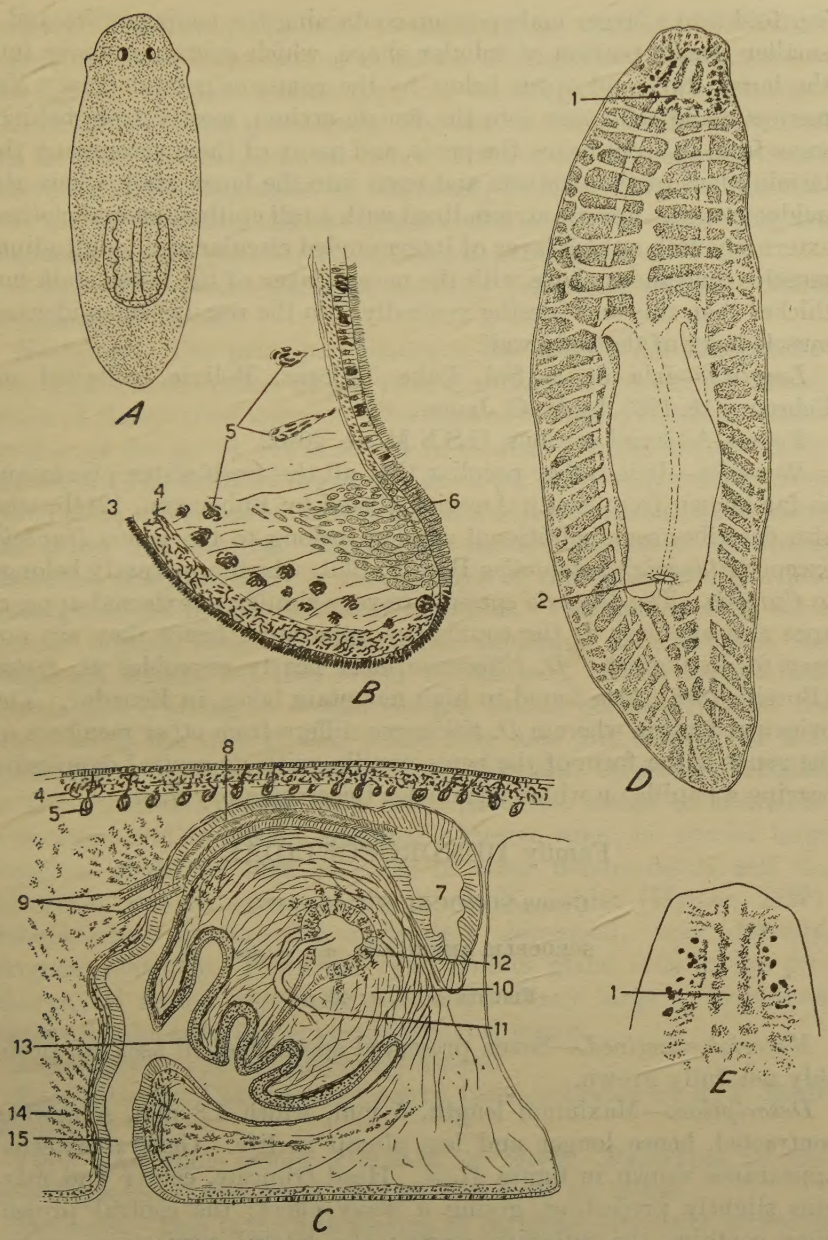

FIGURE 47.—New species of DUGESIA and SOROCELIS

a–c, Dugesia titicacana: a, Type specimen; *b,* posterior end, showing rhabdites, pigment zone, and adhesive zone; *c,* sagittal view of the copulatory complex of the type. *d, e. Sorocelis americana: d,* Entire worm; *e,* head, showing brain and eye arrangement.

1, Brain; *2,* mouth; *3,* rhabdites; *4,* pigment zone; *5,* rhabdite-forming cells; *6,* adhesive zone; *7,* copulatory bursa; *8,* stalk of same; *9,* entrance of oviducts in bursa stalk; *10,* penis bulb; *11,* vas deferens; *12,* seminal vesicle in penis bulb; *13,* penis papilla; *14,* cement glands of atrium; *15,* common genital atrium.

ing fold into a larger male portion containing the penis papilla and a smaller female portion of tubular shape, which continues above into the bursa stalk and opens below by the common genital pore. Numerous gland cells open into the female atrium, mostly from behind, some from in front below the penis, and many of them accompany the terminations of the oviducts and open into the bursa stalk where the oviducts open. Female atrium lined with a tall epithelium and clothed externally with a thick layer of intermingled circular and longitudinal muscles continuous above with the muscle layer of the bursa stalk but thicker than this and passing ventrally into the regular subepidermal muscle layer of the body wall.

Locality.—Isla de la Sol, Lake Titicaca, Bolivia, collected on February 18, 1936, by M. C. James.

Type.—As serial sections, U.S.N.M. no. 20402.

Remarks.—It is rather peculiar that all the fresh-water planarians so far known from South America (listed by Fuhrmann, 1914b, who also describes some additional species) belong to the genus *Dugesia* except "*Planaria*" *patagonica* Borelli, 1901, which apparently belongs to *Curtisia.* The *Dugesia* species are very similar in external appearance and anatomy of the copulatory apparatus; hence they are not easy to distinguish. *D. titicacana* most nearly resembles *D. festae* (Borelli, 1898), also found in high mountain lakes, in Ecuador. The principal feature wherein *D. titicacana* differs from other members of the genus is the form of the penis papilla, with its central depression bearing a papilla on which terminates the ejaculatory duct.

Family DENDROCOELIDAE

Genus SOROCELIS Grube, 1872

SOROCELIS AMERICANA, new species

FIGURES 47, *d, e;* 48, *a*

Material examined.—Seven preserved specimens, all asexual, probably not fully grown.

Description.—Maximum length, 5 mm, width 1.8 mm, somewhat contracted, hence longer and less plump in life. General external appearance shown in figure 47, *d.* Head truncate, center and margins slightly projecting, giving a wavy effect; the central projections contains the adhesive organ; the lateral projections correspond to auricles. Eyes numerous, in a lengthwise arc on each side of the brain, each arc composed of 10 to 20 eyes (fig. 47, *e*). Brain large, of elongated quadrangular shape, giving off numerous branches forward and laterally and the usual two ventral cords pos-

teriorly. Anterior portions of the ventral nerve cords connected by numerous connectives having a netlike arrangement (not shown in the figure). Digestive tract typically triclad (fig. 47, *d*); pharynx unusually large and prominent. Sections of the pharynx show that the circular and longitudinal fibers of the inner muscular layer are intermingled, as diagnostic of the family Dendrocoelidae. This feature serves to distinguish the dendrocoelid genus *Sorocelis* from the planariid genus *Polycelis*, which also has numerous eyes.

Color.—Preserved specimens, uniform yellowish, probably white or creamy in life.

Histology.—The principal feature is the weakly developed adhesive organ, in the center of the ventral surface of the median prominence of the anterior margin. This type of adhesive organ is characteristic of the genus. It is shown in median sagittal section in figure 48, *a*. The adhesive organ is a small pit lined with eosinophilous gland cells, whose bodies extend into the adjacent parenchyma, above and below the intestine. The regular surface epithelium containing rhabdites alters abruptly at the margins of the adhesive organ into these gland-cell outlets devoid of rhabdites. Presumably as in other similar organs, there are attenuated epidermal cells between the gland-cell outlets but they could not be seen. Some longitudinal muscle fibers, acting to deepen the pit, extend posteriorly from the organ along the ventral wall where they soon join the regular subepidermal longitudinal muscle layer. General epidermis cuboidal to low columnar, packed with small rhabdites except on the adhesive organ and the usual marginal adhesive zone; no special large marginal rhabdites such as occur in other dendrocoelids and the American cave planarians of the family Kenkiidae (Hyman, 1937). Subepidermal musculature moderately developed, weak dorsally, stronger ventrally. Numerous cyanophilous gland cells in the prepharyngeal region, especially ventrally. Many large eosinophilous gland cells dorsally in the postpharyngeal region.

Reproductive system completely absent.

Locality.—Bat Cave, Adair County, Okla., collected by A. P. Blair. No date.

Type.—As whole mount, U.S.N.M. no. 20403. Paratypes, as preserved specimens and serial sections, U.S.N.M. no. 20404.

Remarks.—This is the first finding of the genus *Sorocelis*, a typical Asiatic genus of fresh-water triclads, on the American continents. The absence of sexual material makes it impossible to differentiate *S. americana* exactly from other species of the genus, but the combination of plain white color, eye arrangement, and locality should suffice to distinguish it.

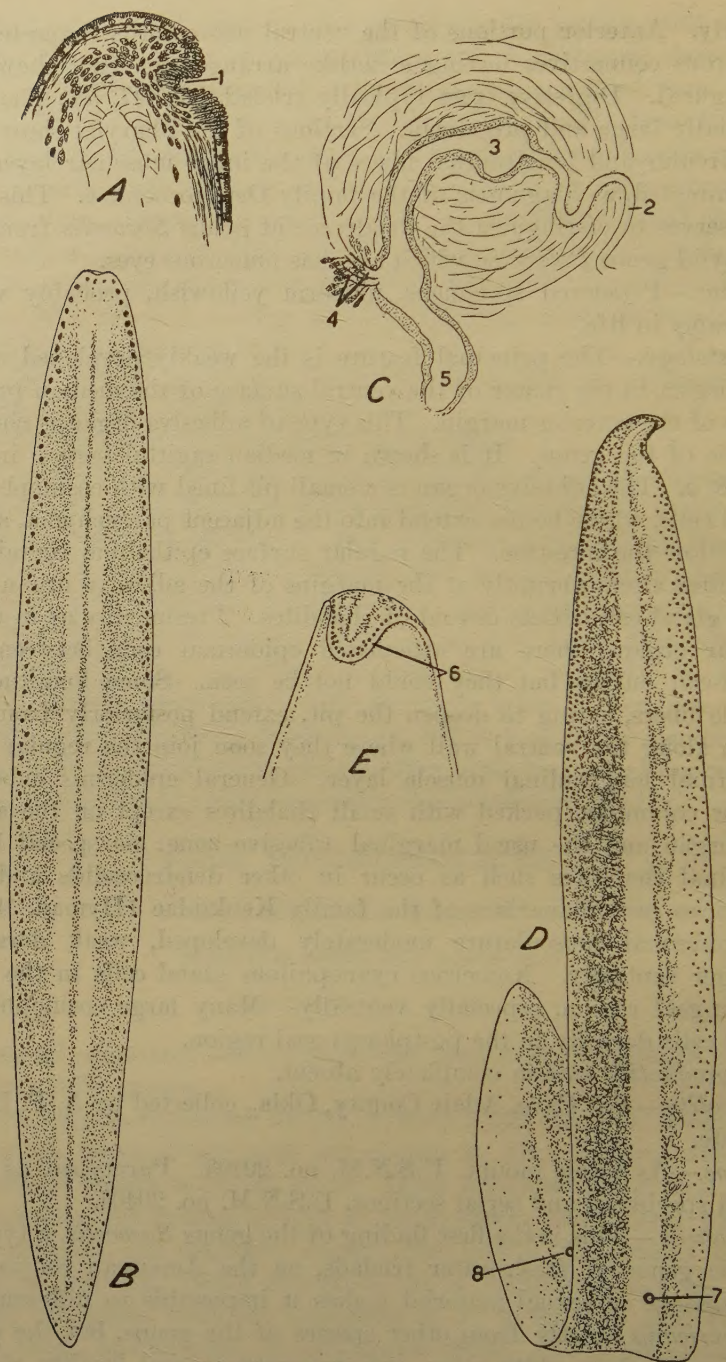

FIGURE 48.—New species of SOROCELIS and GEOPLANA

a, Sorocelis americana: Sagittal section of anterior end, showing the adhesive organ.
b, c, Geoplana mexicana: b, Type specimen; *c,* sagittal view of immature copulatory apparatus.
d, e, Geoplana montana: d, Type specimen; *e,* head, showing eye arrangement and Sinneskante.

1, Adhesive organ; *2,* vas deferens; *3,* male atrium; *4,* oviduct entrance; *5,* common genital atrium; *6,* Sinneskante; *7,* mouth; *8,* genital pore.

Suborder TERRICOLA

Family GEOPLANIDAE

Genus GEOPLANA Stimpson, 1857

What evidence there is available indicates that Stimpson's Prodromus (1857), or at least the signature of the Proceedings of the Philadelphia Academy containing it, was published in February 1857, while the Heft (or fascicle) containing Schultze's quotation of Müller's diagnosis of the genus was published and first available on May 2, 1857 (Abh. Naturf. Ges. Halle, vol. 4, p. 11 of the Berichte appended to the volume, 1858). Ascribing the year 1856 to *Geoplana* Müller, as do some authors, seems to be based on the fact that Leuckart referred to the paper in his "Bericht über die Leistungen in der Naturgeschichte der niederen Thiere während des Jahres 1856" (Archiv für Naturg., Jahrg. 23, Band 2, p. 209, 1857), but this note was published in 1857 and the earliest date assigned to the Müller description of the genus is that of the reprint, "auch als Separatabdruck Halle 1857" (Leuckart).

GEOPLANA MEXICANA, new species

FIGURE 48, *b*, *c*

Material examined.—Two specimens, both immature. Larger specimen selected as type.

Description.—Type, 16 mm long, 2 mm wide at widest part, with an appearance typical of the genus (fig. 48, *b*). Head bluntly pointed, upturned, body increasing in width to about the middle, then tapering to the pointed posterior end. Eyes numerous, extending along the entire margin and across the ventral surface of the anterior end, larger and in single file anteriorly, becoming smaller and less regular in arrangement throughout the middle portion of the body, and few and widely spaced in single file toward the posterior end. About 85 eyes were counted on each side of the type specimen, but the number probably increases with age.

Color.—A slender middorsal dark stripe, bordered on either side by a wider light stripe, then dark to the lateral margins. The dark part of the dorsal surface is a deep brownish black; the two light stripes are probably yellowish in life. Ventral surface uniform medium brown.

Reproductive system.—The type specimen was cut into serial sections, but unfortunately it was only at the onset of sexuality. Testes numerous, ventral, throughout most of the body length. Copulatory apparatus immature, genital pore not yet formed; what was present

is shown in figure 48, *c*. Penis papilla absent; the vasa deferentia enter the anterior end of an elongated tubular chamber, which curves ventrally and after receiving the two oviducts proceeds ventrally and disappears without connecting with the ventral surface. Presumably this ventral extension is the common genital atrium, which would later open through the ventral surface. The whole is surrounded by a tissue rich in muscle fibers. This early condition of the copulatory apparatus closely resembles von Graff's figure (1899, p. 166) of a similar stage of another *Geoplana* species, and in fact it appears that throughout the Terricola the copulatory apparatus generally passes through such a stage. Hence it is impossible to draw any conclusions as to the structure of the mature apparatus of *Geoplana mexicana* from the immature specimen. *G. mexicana* can be differentiated from other members of the genus at present only on the basis of the color pattern.

Locality.—Mexico. The label reads: On violets from Mexico (in cargo) intercepted at Laredo, Texas, Sept. 10, 1935, by M. G. Vinzant."

Type.—As serial sections, U.S.N.M. no. 20405. Paratype, preserved, U.S.N.M. no. 20406.

Remarks.—This species and two others (one known and one new) from Yucatan recently described by the author (Hyman, 1938) are the first land planarians to be recorded from Mexico. They probably represent but a fraction of the terricolous planarians of that country.

GEOPLANA MONTANA, new species

FIGURES 48, *d*, *e*; 49, *a-d*

Material examined.—Four specimens, one small and immature, one in bad condition, the two others fully mature and in a satisfactory state. The one with the best-preserved coloration selected as the type, the other as paratype.

Description.—Type specimen 50 mm long, width at middle of body 5 mm; paratype larger, 70 mm long, 6.5 mm wide at widest region. Head small, rounded (fig. 48, *e*), body quickly widening to a broad flat shape, which it retains to near the posterior end, there tapering to a point (fig. 48, *d*).

Eyes very numerous, a thousand counted on each side of the type specimen, in single file or slightly doubled on the head, quickly increasing to form a broad irregular band several eyes deep toward the middle of the worm, then diminishing in size and number to the posterior end (fig. 48, *d*). Figure 49, *a*, gives the details of the eye arrangement from a region of the body where the eyes are most numerous. The eyes continue around the anterior margin of the head (fig. 48, *e*) bordering the "Sinneskante," or sensory margin, a

white strip of sensory nature forming the body edge. The Sinneskante has been fully treated by von Graff in his classical monograph on the Terricola (1899). Cross section of the body crescentic, gently convex above, plane or slightly concave below, entire ventral surface modified to a creeping sole, as in other members of the genus. Mouth about three-fourths the body length from the anterior end; genital pore of type specimen 7 mm posterior to the mouth. Postpharyngeal portion of the body of both type and paratype removed and cut into serial sagittal sections.

Color.—Dorsal surface with a broad middorsal light-yellow stripe, rest of dorsal surface with a mottled dark-brown pattern on the same light-yellow background (fig. 48, *d*). Details of the pattern in a lateral half are shown in figure 49, *a*; there is simply an irregular marbling with dark brown and light yellow. In the paratype there appears to be more yellow and less dark brown in the marbled pattern with larger yellow areas near the margin; but it is probable that the color has faded during the long sojourn in alcohol. Ventral surface dull white, with a little brown pigment on the head.

Reproductive system.—Both specimens have a mature copulatory apparatus, but the accompanying gland cells are much better developed in the paratype. Sagittal section combined from type and paratype shown in figure 49, *b*. The genital pore leads dorsally into the large genital atrium, divisible into an anterior extension, the male atrium, containing the penis papilla, and a posterior extension, the female atrium. Penis with poorly developed bulb; penis papilla large, of elongated conical form, extremely muscular, the interior filled with sinuous muscle fibers, which course mostly in a longitudinal direction and at the penis base curve posteriorly to become continuous with the muscle layer of the genital atrium and the parenchymal fibers. The penis papilla is clothed with a low cuboidal epithelium in which cell walls could not be distinguished (fig. 49, *c*); beneath the epithelium there appears to be no definite muscle layer except toward the penis base but a syncytial network. This is crossed at intervals by bundles of muscle fibers, which reach the surface of the penis, sometimes elevating this into a small papilla. Where these muscle bundles come to the surface, the regular epithelium appears to be modified (fig. 49, *c*), but the available sections are not thin enough to reveal the histology of the terminations of these muscle bundles. They seem to inclose some large cells, which may be gland cells. Fuhrmann (1914a) has observed similar muscle bundles terminating in papillae in the penis of *Geoplana vonguteni* from Colombia. He believes these papillae contain gland cells whose contents are squeezed out by the muscle fibers encircling them. He also found the muscle bundles indicated in *Geoplana cameliae*. Penis

papilla traversed throughout its length by the tubular ejaculatory duct lined by a cuboidal ciliated epithelium. At the penis base, the duct curves ventrally, then turns anteriorly, enlarging into an elongated chamber, the seminal vesicle (fig. 49, *b*), called seminal duct by von Graff (1899), who found a similar condition in *Geoplana marginata* F. Müller, 1858. *Geoplana cameliae* Fuhrmann, 1914a, also has a seminal vesicle external to the penis papilla, much like that of *G. montana.* As a rule, the seminal vesicle in planarians is inside the penis bulb, but these species lack a definite penis bulb. The seminal vesicle of *G. montana* is lined by a ciliated epithelium and in the paratype is surrounded by a halo of eosinophilous glands opening into it; at its anterior end it receives the two vasa deferentia. The female atrium, of elongated-funnel form (fig. 49, *b*), extends posteriorly from the common atrium; it lacks any special muscular thickening and hence is not regarded as a vagina. At its posterior end, the female atrium continues into the glandular duct ("Drüsengang" of German workers), which curves ventrally as a tube into whose lower end the two oviducts open. Genital atrium lined by a very tall extremely glandular epithelium, particularly well developed in the female atrium, where in the most mature specimen (the paratype) it is thrown into villuslike folds. Toward the male atrium the epithelium gradually diminishes in height and after turning to cover the penis papilla soon flattens down to the cuboidal epithelium of the latter (fig. 49, *c*); at the genital pore the epithelium is continuous with the rhabdite-containing body epithelium, here also very tall. Free ends of atrial epithelium filled with granules (fig. 49, *d*) staining blue in Mallory's connective tissue stain, hence probably mucous in nature; their source could not be determined, as no gland cells were seen in the adjacent parenchyma. Outside the atrial epithelium is a somewhat indefinite muscle layer continuous with the parenchymal fibers, best developed in the female atrium and diminishing toward the base of the penis. Glandular duct lined by a tall columnar epithelium interspersed with the outlets of the innumerable gland cells, which in the paratype form an immense halo around the duct and also extend into the parenchyma some distance posterior to the duct; gland cells of both cyanophilous and eosinophilous types. Gland cells also accompany the terminal portions of the oviducts.

Locality.—Type and young immature specimen collected at Coronado, Costa Rica, at 1,600 meters, by S. Rafael, April 12, 1935. Paratype collected at Volcán Barba, Costa Rica, at 2,800 meters, by M. Valerio, January 31, 1929. Fourth specimen, in bad condition, considered probably the same species, collected at San José, Costa Rica, 1,160 meters, by M. Valerio, no date, probably 1929.

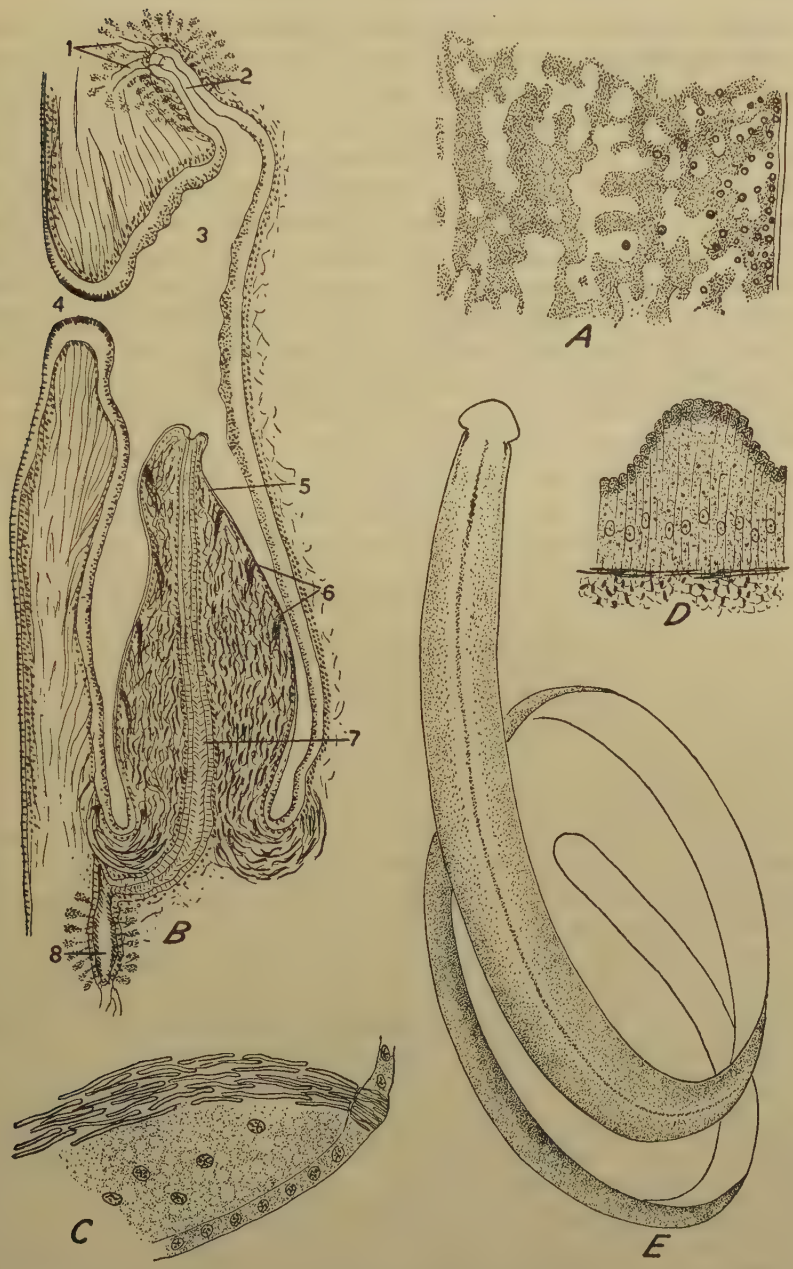

FIGURE 49.—New species of GEOPLANA and BIPALIUM

a–d, Geoplana montana: a, Small portion of lateral half, showing color pattern and eye arrangement; *b,* sagittal view of the copulatory apparatus, combined from type and paratype; *c,* small portion of the penis papilla, showing epithelium and one of the muscle bundles; *d,* atrial epithelium with granular tips.

e, Bipalium costaricensis: Type specimen.

1, Oviduct entrance; *2,* glandular duct; *3,* female atrium; *4,* common genital pore; *5,* penis papilla; *6,* muscle bundles of penis; *7,* ejaculatory duct; *8,* external seminal vesicle with gland cells.

Type.—U.S.N.M. no. 20407, including serial sections of postpharyngeal region. Paratype, U.S.N.M. no. 20408, including serial sections of postpharyngeal region.

Remarks.—*Geoplana montana* is seen to be an inhabitant of mountain regions in Costa Rica. Its collection in three different localities, at different times and by different collectors, indicates that the species must be relatively common. It is closely related and very similar in sexual anatomy to *Geoplana cameliae* Fuhrmann, 1914a, found at 1,400–1,800 meters in the central Cordilleras of Colombia. It differs from this species in color pattern, eye distribution, greater muscularity of the penis papilla, and much better development of the glandular duct. It is a question whether *G. montana* should not be regarded as a geographical variety of *G. cameliae*, but on present knowledge it seems best to make a separate species of it. One is forced to place considerable weight on differences in color pattern, because of the many similarities in general structure and sexual anatomy between the numerous species of *Geoplana*.

Family BIPALIIDAE

Genus BIPALIUM Stimpson, 1857

BIPALIUM COSTARICENSIS, new species

FIGURES 49, *e*; 50, *a*

Material examined.—Two specimens, both asexual.

Description.—Type, over 100 mm long (much coiling of the body made it impossible to get the exact length); paratype, about 80 mm long; width anteriorly, 3 mm. One of the long, slender species of *Bipalium*. Head 4 mm wide, typical of the genus. Arrangement of the eyes on the head shown in figure 50, *a*, dorsal surface to the right, ventral to the left. Behind the head, the body first widens slightly, remains of this width for about the anterior third of the body, then gradually diminishes to the rounded posterior end.

Color.—There is a very narrow middorsal black line that gradually disappears posteriorly; to either side of this the drab background gradually takes on a dark-brown color, which increases to the lateral margins. Posteriorly also the dark-brown color gradually intensifies until the posterior fourth of the body is a dark brownish black, slightly lighter toward the median region. Color descriptions based on alcoholic specimens several years old are, of course, not very reliable, but both specimens give the same impression as to color shades and pattern, although one is much more faded than the other. The latter, selected as the type, appears not to have suffered much loss of color. Ventral surface drab, with the midventral creeping ridge typical of the genus.

Sections of the postpharyngeal region of both specimens failed to show any trace of sex organs. The specific diagnosis therefore rests on shape and color pattern.

Locality.—Type and paratype collected at San José, Costa Rica, at 1,160 meters, by M. Valerio, June 15, 1929.

Type.—U.S.N.M. 20409, including serial sections of pharynx and adjacent region. Paratype, U.S.N.M. no. 20410, including also a piece removed for sectioning.

Family RHYNCHODEMIDAE

Genus RHYNCHODEMUS, Leidy, 1851

RHYNCHODEMUS TERRESTRIS (O. F. Müller, 1774)

FIGURE 50, *b*, *c*

Material examined.—A single specimen.

Description.—Specimen 12 mm long, cylindroid, both ends rounded, anterior end larger than posterior (fig. 50, *b*), this probably the result of contraction. Eyes not seen in the whole specimen but found in sections as a pair at the anterior tip. Cut into sagittal serial sections, but through the mistake of trying to stain the slides before the sections were fully dried the series was badly damaged. Sufficient remains, however, to enable one to reconstruct the copulatory apparatus.

Reproductive system.—The genital system was found to be so nearly identical with that of the European *Rhynchodemus terrestris* that after some indecision the specimen is placed in that species. The slight differences found are probably the result of various degrees of contraction and do not seem to warrant the erection of even a variety. Sagittal view of the copulatory apparatus is shown in figure 50, *c*. Genital pore communicates with genital atrium by a long canal; genital atrium occupied by the penis. Penis with well-developed bulb and papilla; papilla and bulb more elongated and slender than shown in figures of European specimens (e. g., by Bendl, 1908), but this probably is the result of a greater extension. Penis and bulb extremely muscular with a longitudinal muscle layer under the flattened epithelium of the papilla; bulb with numerous strong transverse fibers, appearing like a network. Each vas deferens enlarges slightly near the penis bulb to an external seminal vesicle, then narrows again, and enters the bulb where both join an elongated seminal vesicle lined by a high glandular epithelium. In European specimens this internal seminal vesicle is figured as a large rounded sac; in the present specimen it is elongated, but this again is referable to the extended state of the penis. In the penis papilla, the seminal vesicle narrows to an ejaculatory duct lined by a flat epithelium, which proceeds to the penis tip. Floor and rear of genital atrium lined by a very high

epithelium underlain by an indistinct muscularis, of inner circular and outer longitudinal fibers. From just behind the genital canal leading to the genital pore, the female canal starts and proceeds straight posteriorly, then widens into a chamber, which receives the two oviducts. The proximal part of this female canal is called vagina by Bendl (1908), but as it has no special musculature it is best regarded as a glandular duct. Gland cells were not evident in the present specimen; Bendl figures many opening into the duct. From the chamber that receives the oviducts, a tube runs anteriorly again,

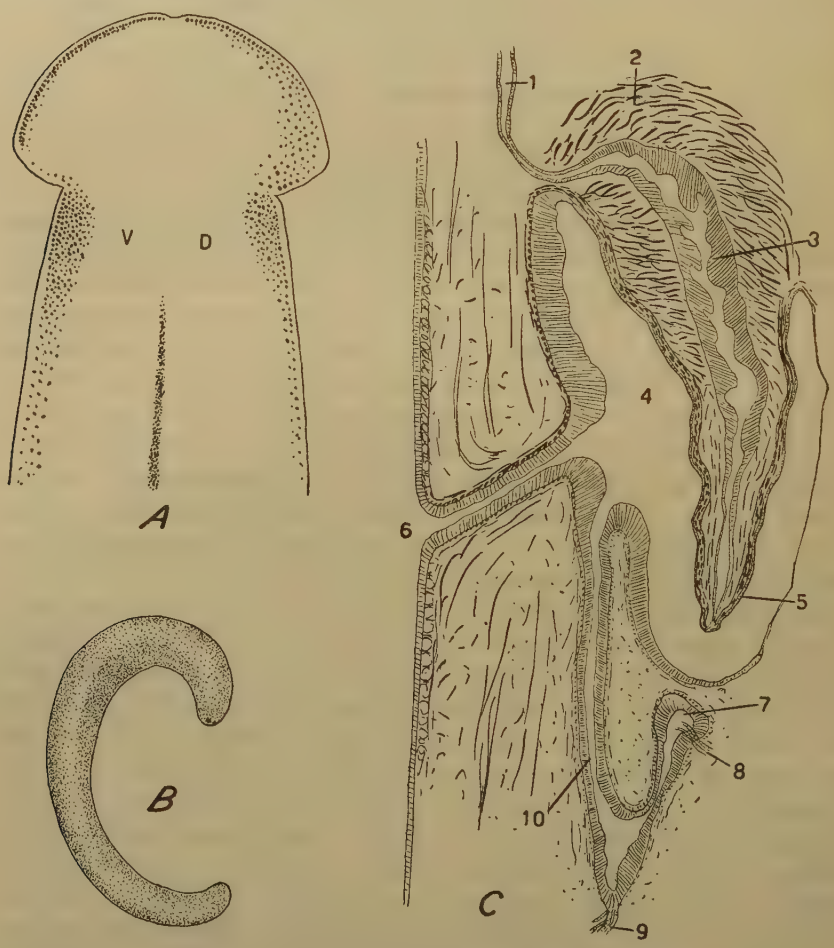

FIGURE 50.—Species of BIPALIUM and RHYNCHODEMUS

a, Bipalium costaricensis, new species: Showing eye arrangement—left half (V) is ventral surface, right half (D) is dorsal surface.

b, c, Rhynchodemus terrestris (O. F. Müller): *b,* Wisconsin specimen, side view; *c,* sagittal view of copulatory complex.

1, External seminal vesicle of vas deferens; *2,* penis bulb; *3,* internal seminal vesicle in penis bulb; *4,* male atrium; *5,* penis papilla; *6,* genital pore; *7,* seminal bursa (so-called uterus); *8,* genito-intestinal duct from same to intestine; *9,* entrance of oviducts; *10,* glandular duct.

widening into a sac very near the wall of the genital atrium. This diverticulum is called uterus by some authors, seminal receptacle by others; it is probably actually a copulatory bursa. In *R. terrestris* it gives off a pair of genito-intestinal ducts connecting with the adjacent intestine, one on each side. These ducts were seen in the present specimen but owing to the damage to the sections could not be traced into the intestine. Glandular duct and seminal receptacle are lined by a tall epithelium probably ciliated.

Color.—Jet black, uniform.

Locality.—In rotten wood in woods near Oconomowoc, Wis.; collected in July 1927, by Cahn.

Remarks.—This is the third land planarian, all species of *Rhynchodemus*, to be found in the United States. The other two, *R. sylvaticus* (Leidy, 1851) and *R. atrocyaneus* Walton, 1912, are presumably endemic, although so imperfectly known that it is difficult to draw conclusions about them. A study of serial sections of the copulatory apparatus is badly needed. At first the present specimen was thought to be a new species, but study of the copulatory apparatus revealed no good grounds for separating it from *R. terrestris*. The best figure of the copulatory apparatus of European specimens is that of Bendl (1908). As already remarked, the Wisconsin specimen differs from this figure in the following respects: Long genital canal between genital pore and atrium; more elongated penis papilla and seminal vesicle; and different shape of the seminal receptacle. These differences, however, seem to result from a less contracted condition of the parts than in Bendl's figure and do not appear to justify the creation of a new species or subspecies, especially as the European specimens vary considerably in color and sexual anatomy. In view of the wide distribution of *R. terrestris* in a variety of localities in Europe, its invasion into the United States is perhaps not surprising.

Order POLYCLADIDA

Suborder ACOTYLEA: Section SCHEMATOMMATA

Family LEPTOPLANIDAE

Genus LEPTOPLANA Ehrenberg, 1831 (emend. Bock, 1913)

LEPTOPLANA VESICULATA, new species

FIGURE 51

Material examined.—One specimen.

Description.—Specimen 22 mm long, 11 mm wide. Of general oval form (fig. 51, *a*), with ruffled edges, hence somewhat contracted, with the typical appearance of a leptoplanid. No tentacles, eyes in usual four clusters, paired rounded tentacular clusters of about 40–45 eyes, and paired elongated cerebral clusters of about 70–80 eyes. Pharynx of typical ruffled leptoplanid type, central, encircled by the uterus packed with eggs (fig. 51, *a*); mouth posterior to center but contraction of the specimen may have altered its true position.

Color.—Indeterminate, on account of long sojourn in alcohol, probably consisting of brown flecks dorsally.

Reproductive system.—Male apparatus shortly behind the pharynx, female pore shortly behind the male pore; genital sucker present between male and female pores (fig. 51, *b*). Postpharyngeal portion of specimen removed and sectioned serially; found to be in full sexual maturity. Sexual apparatus characteristic of the genus *Leptoplana* (sensu stricto, Bock, 1913) but with a Lang's vesicle absent in the type species of the genus. Sagittal semidiagrammatic view of copulatory apparatus shown in figure 51, *b*. The male genital pore leads into a vertical tubular cavity, the antrum masculinum, which, as in the type species [*L. tremellaris* (Müller, 1774)], is provided with a fold, termed by Bock the penis sheath. The portion of the antrum dorsal to this fold is called by Bock the penis pocket. At its dorsal termination it has the penis papilla, here very slightly developed, even less so than in *L. tremellaris*. From the penis the male duct continues dorsally as a tube considered by Bock to represent the granule vesicle; no glands entering this tube are evident in the present specimen. At its upper end the granule vesicle (if such it be) has the same lateral diverticulum found in *L. tremellaris*. The male duct now turns sharply forward as a slightly expanded tube, then bends dorsally again to enter the seminal vesicle. This is a highly muscular rounded mass composed chiefly of circular fibers. It contains a tubular cavity, slightly enlarged to a little rounded chamber where the common vas deferens enters from behind. The two vasa deferentia appear

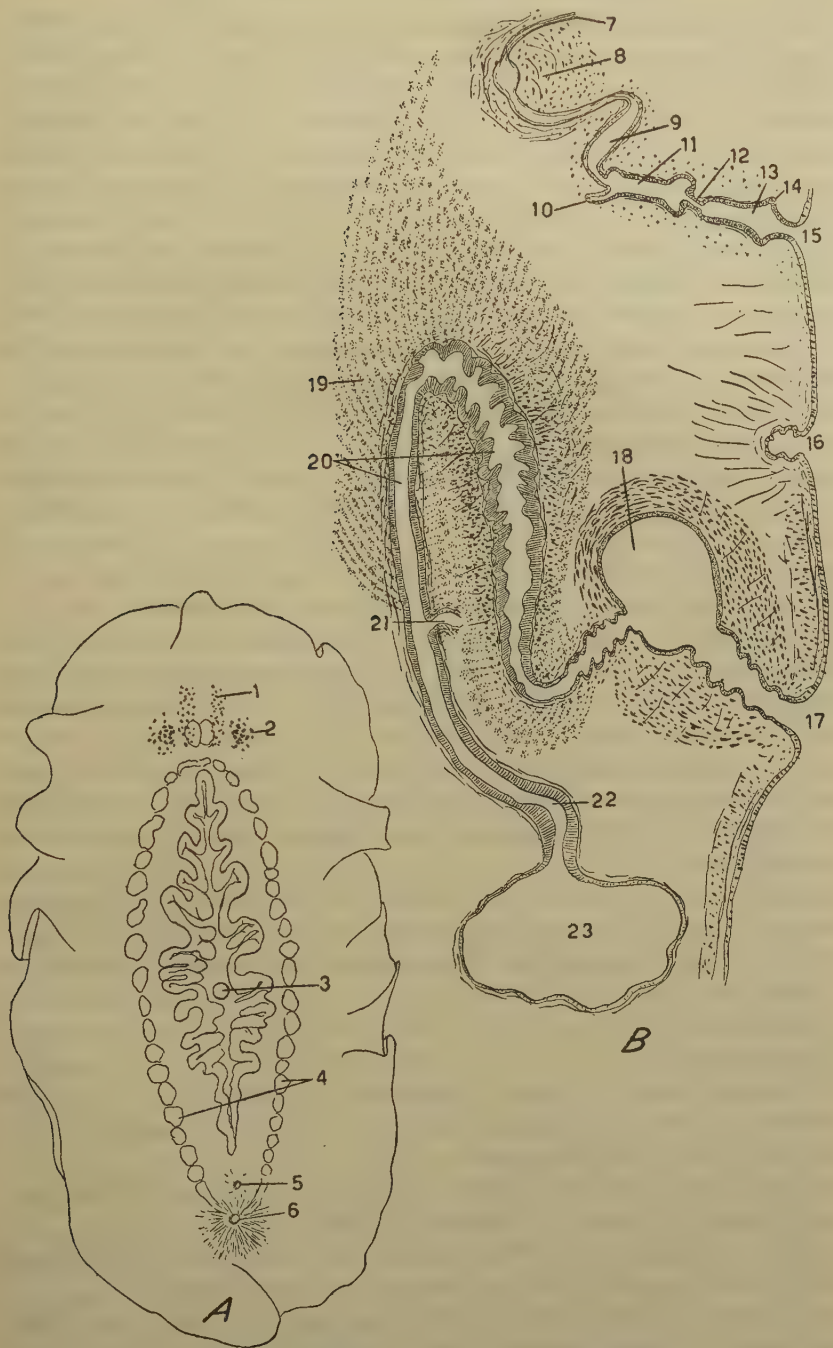

FIGURE 51.—LEPTOPLANA VESICULATA, new species

a, Type.
b, Sagittal view of copulatory complex.

1, Cerebral eyes; *2*, tentacular eyes; *3*, mouth; *4*, uterus; *5*, male pore; *6*, female pore; *7*, vas deferens; *8*, seminal vesicle; *9*, duct from seminal vesicle to granule vesicle; *10*, proximal diverticulum of granule vesicle; *11*, granule vesicle; *12*, penis; *13*, penis pocket; *14*, penis sheath; *15*, male pore; *16*, genital sucker; *17*, female pore; *18*, bulbous vagina; *19*, cement glands of glandular duct; *20*, glandular duct; *21*, entrance of common uterine duct; *22*, stalk of Lang's vesicle; *23*, Lang's vesicle.

to unite to a common duct before entering the seminal vesicle. Apart from the very muscular seminal vesicle, the male duct is but slightly muscular encircled by sparse circular fibers. It is lined by a low cuboidal epithelium, which is very granular from the beginning of the granule vesicle to the male pore. Between the male and female pores is the small bowl-shaped invagination of the genital sucker lined by a granular epithelium and showing some concentration of dorsoventral parenchymal muscle fibers. The female apparatus, in contrast to that of *L. tremellaris*, is very strongly developed. The female pore, situated on an elevation, leads into a large vagina with thick muscular walls, the fibers chiefly circular, and a granular epithelial lining. The upper end of the vagina is widened into a large sac-like cavity from the posterior wall of which springs the glandular duct (Kittdrüsengang of Bock, 1913). This type of vagina in Bock's terminology would be a bulbous vagina. The glandular duct is a large tube running forward and then backward in the sagittal plane, having thus a V-shape. It is lined by an epithelium of tall slender cells outside of which there is a considerable muscular investment, mostly of circular fibers with a few longitudinal ones next the epithelium. The glandular duct receives a tremendous array of long-necked eosinophilous gland cells, which occupy the parenchyma around the whole course of the duct and extend for long distances in all directions. These glands are the shell glands of early authors but are now generally designated cement glands (Kittdrüsen) and no doubt secrete the adhesive material in which the eggs are imbedded on laying. At its proximal end the glandular duct receives on its ventral side the very short common uterine duct which almost at once divides into the two uteri; these proceed forward one on each side of the pharynx (fig. 51, *a*) as wide, thin-walled, coiled canals stuffed with eggs. Behind the entrance of the uterine duct the female canal continues as a duct, which after proceeding posteriorly for some little distance widens into a large sac, Lang's vesicle in Bock's terminology. The duct between this vesicle and the entrance of the uterine duct is thus the stalk of Lang's vesicle. In the type species, *L. tremellaris*, Lang's vesicle is reduced to a slight protuberance beyond the uterine duct.

Locality.—Under rock, Mount Doughty, Puget Sound, Wash., collected on July 15, 1927, by Everett E. Wehr.

Type.—Anterior three-fourths as preserved specimen, U.S.N.M. no. 20411, including serial sections of postpharyngeal region.

Remarks.—In his classical revision of the polyclads, Bock (1913) has accepted Lang's opinion that *Leptoplana tremellaris* (O. F. Müller, 1774) is the first species to be ascribed to the genus *Leptoplana*, and the diagnosis of the genus must then be based on *L. tremellaris*,

of which Bock figures the copulatory apparatus. Unfortunately, *L. tremellaris* differs markedly in its sexual anatomy from the great majority of the many species that have been put into *Leptoplana* in the hundred years since the genus was founded, and so it becomes necessary to allocate practically all the older *Leptoplana* species to other genera. Most of them belong in *Notoplana* Laidlaw, 1903. Bock does not list any other species but *tremellaris* under *Leptoplana.* The present species, *L. vesiculata*, clearly belongs in *Leptoplana* and justifies the concept of a leptoplanid genus built around *L. tremellaris.* The distinguishing features of the genus are the wide separation of the genital pores with a genital sucker between them, the well-developed seminal vesicle, the tubular, poorly differentiated granule vesicle without definite external limitation, with a proximal diverticulum, and the small unarmed penis in a long penis pocket. Since *L. vesiculata* has a large Lang's vesicle, Bock's definition of *Leptoplana* (1913, p. 181) must be emended to read: "Lang's vesicle developed or rudimentary."

The only previous publication on the polyclads of the Puget Sound region is that of Freeman (1933). He does not list any species of *Leptoplana*, and it is obvious that *L. vesiculata* is not identical with any of the species he describes. Polyclads from the California coast have been studied by Plehn (1896, 1898), Heath and McGregor (1912), Boone (1929), and Freeman (1930). Bock has transferred Plehn's *Leptoplana californica* to the genus *Stylochoplana.* Heath and McGregor describe four new species of "*Leptoplana.*" Of these, *L. rupicola* probably belongs to *Notoplana*, *L. timida* is probably not a *Leptoplana*, since it has a large penis and definite granule vesicle, *L. saxicola* is evidently a *Notoplana*, and *L. inquieta* with its common genital pore would also not fit into *Leptoplana.* Boone (1929) figures "*Leptoplana*" *sciophila* with a chambered granule vesicle (whose nature she failed to understand), and hence this species is either a *Stylochoplana* or a *Notoplana.* "*Leptoplana*" *acticola* is also stated by Boone to have a large granule vesicle (which she calls ejaculatory organ and figures badly), and it must therefore be removed from *Leptoplana.* After all that has been said by the foremost students of the Turbellaria on the absolute necessity of a study of serial sections in the taxonomy of this group, there appears to be no excuse for the further publication of taxonomic descriptions based only on whole mount studies. These California forms must be restudied before they can be allocated to the proper genera.

It thus appears that *Leptoplana vesiculata* is the only member of the genus so far found on the Pacific coast of the United states. Old descriptions of *Leptoplana* species from the Atlantic coast cannot be evaluated until the specimens are reexamined.

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